

WHAT IS CLAIMED IS:

1. A process to produce N-vinylformamide comprising the steps of: reacting hydroxyethyl formamide with a reactant comprising at least one cyclic anhydride group to form an ester, and dissociating the ester via heat in a thin film evaporation to synthesize N-vinylformamide and a compound comprising at least one diacid group, the N-vinylformamide separating from the diacid during the thin film evaporation.
2. The process of Claim 1 wherein the reactant comprising at least one cyclic anhydride group is succinic anhydride, maleic anhydride, phthalic anhydride, (2-dodecen-1-yl)succinic anhydride, *exo*-3,6-epoxy-1,2,3,6-tetrahydrophthalic anhydride, or a polymer comprising at least one cyclic anhydride group.
3. A process of claim 1 wherein the cyclic anhydride is regenerated from a diacid formed in the synthesis of the ester by dehydrating the diacid.
4. The process of claim 1 where NVF is used as a solvent.
5. The process of claim 1 where toluene or acetaldehyde is used as a solvent.
6. The process of claim 2 wherein the reactant comprising at least one cyclic anhydride is succinic anhydride, maleic anhydride or phthalic anhydride.
7. The process of claim 1 wherein acetaldehyde, formamide and the reactant comprising at least one cyclic anhydride group are mixed in a single reaction vessel, hydroxyethyl formamide being formed in the reaction vessel to react with the reactant comprising at least one cyclic anhydride group.
8. The process of Claim 7 wherein the single reaction vessel is a pressurized vessel.
9. The process of Claim 8 wherein the reactant comprising at least one cyclic anhydride group is succinic anhydride, maleic anhydride, phthalic anhydride, (2-dodecen-1-yl)succinic anhydride, *exo*-3,6-epoxy-1,2,3,6-tetrahydrophthalic anhydride, or a polymer comprising at least one cyclic anhydride group.

10. A process of claim 8 wherein the cyclic anhydride is regenerated from a diacid formed in the synthesis of the ester by dehydrating the diacid.
11. The process of claim 8 where NVF is used as a solvent.
12. The process of claim 8 where toluene or acetaldehyde is used as a solvent.
13. The process of claim 9 wherein the reactant comprising at least one cyclic anhydride is succinic anhydride, maleic anhydride or phthalic anhydride.
14. A process to produce N-vinylformamide comprising the steps of: mixing acetaldehyde, formamide and a source of anhydride in a single reaction vessel, reacting the acetaldehyde, formamide and the source of anhydride in the reaction vessel under pressure, dissociating an ester formed by a reaction between the source of anhydride and hydroxyethyl formamide formed in the reaction vessel to synthesize N-vinylformamide and a compound comprising at least one diacid group.
15. The process of claim 14 wherein the source of anhydride is a reactant comprising at least one cyclic anhydride group.
16. The process of Claim 15 wherein the reactant at least one cyclic anhydride group is succinic anhydride, maleic anhydride, phthalic anhydride, 2-dodecen-1-yl)succinic anhydride, *exo*-3,6-epoxy-1,2,3,6-tetrahydrophthalic anhydride, a polymer comprising at least one cyclic anhydride group, or a solid support to which at least one cyclic anhydride group is covalently tethered.
17. The process of Claim 14 wherein the acetaldehyde to formamide mole ratio is at least two.
18. A process of claim 14, where a base or an acid catalyst is used in the reaction to make hydroxyethyl formamide.
19. The process of claim 16 wherein the reactant comprising at least one cyclic anhydride is succinic anhydride, maleic anhydride or phthalic anhydride.